A 14 000 year-old hunter-gatherer's toolkit

Phillip C. Edwards*

Research

A sickle, 21 flint lunates for tipping spears and evidence of the hunted quarry – gazelle bones – lay together by the wall of a Natufian building. The author deduces that these objects were contained in a bag and constituted the versatile working equipment of a hunter-gatherer.

Keywords: Natufian, Jordan, agriculture, hunting, projectile, sickle

Introduction

A cache of 36 objects provides a rare insight into the organisation of hunting and gathering technology by a late Pleistocene hunter-gatherer community which lived in the Jordan Valley around 12 000 BP/12 000 cal BC. The items were found at the Early Natufian site of Wadi Hammeh 27 (Figure 1) and include an intact sickle and an incomplete bone haft, set amid other groups of artefacts and materials, including five gazelle podial bones, seven polished alluvial pebbles, 21 lunates (a characteristic type of Natufian flint projectile point) and a flint bladelet core (Edwards 1991a). The items comprising Artefact Cluster 9 (Figure 2) were deposited on the interior earthen floor of Structure 1, one of two dwellings excavated from the uppermost occupation phase (Phase 1) of the site (Figure 3).

The Natufian culture (Garrod 1932) developed in the southern Levant in the terminal Pleistocene around 13 000 BP (Weinstein-Evron 1998; Stutz 2004). Representing the antecedent to agrarian village life in the Middle East, the Natufian marks a critical juncture in human prehistory (Byrd 1989; Valla 1998; Bar-Yosef 2002). Intensive exploitation of plant resources was associated with a reduction in residential mobility and the foundation of residential settlements containing substantial stone dwellings. Human burials were incorporated beneath and between the floor levels of houses. Novel artefact forms were produced to procure and process plant resources, including composite sickles made of bone and flint and a diverse array of basalt mortars, querns, pestles and grinding stones. The Natufian also witnessed a florescence of mobiliary art, with the production of various symbolic representations rendered on tools and ornaments of bone and stone.

These aspects of the Natufian culture are well in evidence at Wadi Hammeh 27, excavated between 1983 and 1990. Two large, oval huts were excavated from the site's uppermost phase, dated to *c*. 12 000 BP/12 000 Cal BC (Edwards 1991a). Both were associated with a variety of stone features such as hearths, postholes and pavements. Beneath Phase 1 were stratified two earlier constructional phases which in turn overlay several human burials (Webb & Edwards 2002). The site yielded a varied corpus of *art mobilier* ranging from large-scale

* *Archaeology Program, La Trobe University, Victoria 3086, Australia (Email: p.edwards@latrobe.edu.au)*

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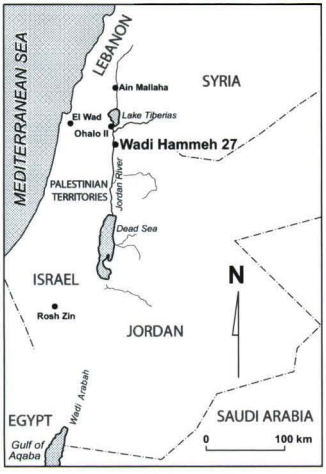

Figure 1. The location of Wadi Hammeh 27 and other sites mentioned in the text.

incised slabs to small plaques. The occupants subsisted on a diverse fauna, and botanical remains attest to cereal and legume exploitation. Many caches of tools, raw materials and refuse (Artefact Clusters 1-17, Figure 4) were deposited at Wadi Hammeh 27, embedded in a rich amalgam of refuse which comprised bone scraps, flint fragments, ochre and tools, and ornaments of bone, shell, limestone, siltstone, basalt - and even dispersed human skeletal remains (Hardy-Smith & Edwards 2004). Most of the artefact clusters were placed close to the opening of Structure 1, or near the walls of Structures 1 and 2.

Wadi Hammeh 27 is situated in an ecotonal setting between Irano-Turanian steppic lowlands and Mediterranean highlands, at an altitude of 83.5m below mean sea level. During the period of its occupation, the site lay in a broad, flat valley, watered by aquifers emerging a

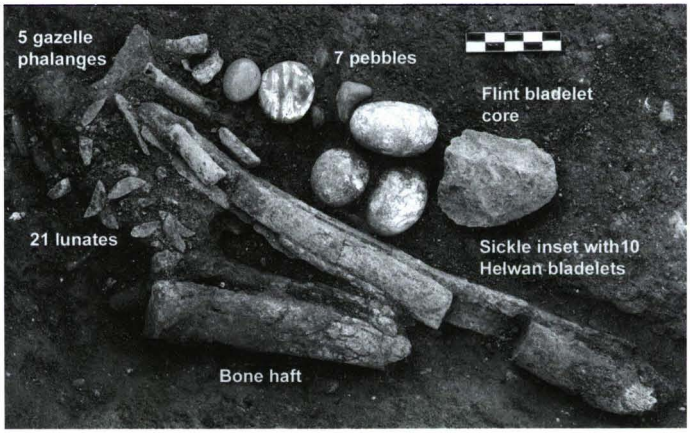

Figure 2. Artefact Cluster 9, Wadi Hammeh 27 (scale = 5cm).

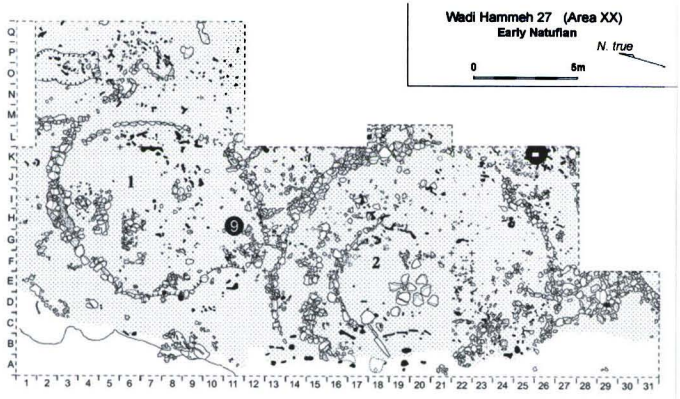

Figure 3. The uppermost phase of Wadi Hammeh 27 (Phase 1, indicated by dot-shading) showing the position of Artefact Cluster 9 (the black-circled numeral '9').

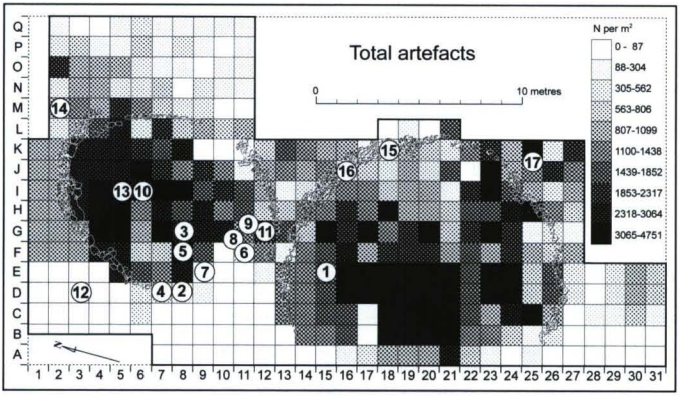

Figure 4. Wadi Hammeh 27, Phase 1. Numbered white discs mark the positions of Clusters 1–17. The exterior walls of Structures 1 and 2 are superimposed on a plot of total artefact density.

couple of hundred metres upstream (Macumber 1992). A variety of environmental zones were accessible within a few minutes walk in any direction, including wooded areas on the Jordanian Plateau to the east and the lowlands of the Jordan Valley to the west. It is

likely that the Jordan Valley was then occupied by a lake, bordered by marshy shores and embayments (Abed 1985). Such environments provided habitats for the various aquatic and migratory birds found in the Wadi Hammeh 27 fauna. The rich Mediterranean red soils of the Tabaqat Fahl massif located to the south-west of the site would have supported pastures of wild grasses.

The context and composition of Artefact Cluster 9

Artefact Cluster 9 was located near the entrance to Structure 1 (Figure 3; Grid-square G11, Figure 4), a metre inside its perimeter wall and near to a pair of grooved basalt plaques (Artefact Cluster 8 on Figure 4). The objects were delineated within an oblong space, 33cm long by 23cm wide. Both Artefact Cluster 8 and Artefact Cluster 9 were laid directly on the compacted mud floor of Structure 1 (which in this area of the site was Locus 5.3, in excavation plot XX E). This surface is part of the broader Phase 1 floor, indicated by grey stippling in Figure 3. The finds were overlain by a dark grey clay layer (in this area, Locus 5.2), part of the major interior fill of Structures 1 and 2. A thin layer of whitish sediment which underlay Artefact Cluster 9 may have derived from a perished organic container. Moreover, the small items at the southern end of the artefact complex were bordered by a marked convexity, consistent with their having been stored in a container of that shape (Figure 2). The intriguing possibility that Artefact Cluster 9 represents a Late Pleistocene bag of equipment is explored further after the constituents are described in detail, according to the Registration numbers (RN) assigned to each item or group.

Figure 5. Seven pebbles (RN 100040), part of Artefact Cluster 9.

The five *gazelle podial bones* (RN 100069) in Artefact Cluster 9 comprised two first phalanges, two second phalanges and one third phalanx, located near the distal end of the sickle. The shafts of all elements were broken, though not severed by cutting or sawing. A group of seven *alluvial pebbles* (RN 100040) was located above the sickle, mid-way along its shaft (Figure 5). Three larger siliceous limestone pebbles were located to the right of four highly polished stones. One of the former stones bore pitting marks on one end. A single platform *bladelet core* (RN 100046) was located to the right of the limestone pebbles (Figure 6). The core length along the flaking axis from platform to heel was 56.1mm. The core was reduced from a piece of translucent tan flint, the same material as used for the group of *lunates* (RN 100047) included in the artefact cluster. The 'lunate' is a crescentic Natufian microlith (Garrod 1932), formed by retouch applied to the lateral edge of a bladelet or small flake. Thirteen specimens were located between the sickle and the fragmentary bone haft (Figure 7). One was broken but the other 12 were intact. The mean length of the complete

Figure 6. Flint bladelet core (RN 100046), part of Artefact Cluster 9.

Figure 7. Thirteen flint lunates (RN 100047), part of Artefact Cluster 9.

items was 21.2mm, SD = 0.82mm, range = 19.8-22.5mm). Eleven of the lunates bore 'Helwan' retouch (semi-steep retouch applied bifacially to an edge, Bar-Yosef 1970: 220) and two were inverse-retouched lunates. Eight more lunates were later retrieved from sieved sediment excavated beneath Artefact Cluster 9.

The *sickle* (RN 100094), which formed the centrepiece of the collection, was made of two pieces of caprid horn-core, split longitudinally, and then rejoined to form a single haft. Both pieces were grooved longitudinally and fitted with 10 retouched bladelets set in parallel ranges (Figure 8). Each groove was fitted with five Helwan bladelets, colour-matched, with one row made on a pale brown flint (Munsell colour 10 YR 8/2) and the other made on a grey flint (10 YR 6/1) with white mottling (10YR 8/1). Seven of the bladelets were straight-truncated on either end, two were straight-truncated at one end with a snap-break at the other, and one bladelet combined straight and convex truncations. The mean length for the 10 bladelets was 36.4mm (standard deviation = 5.3mm, range = 30.5-45.3mm). Two sections of a bone *handle* (RN 100061 and RN 100093), originally joined as corresponding halves in the manner of the adjacent sickle, lay at a slight angle to the latter tool (Figure 2). One terminal (RN 100093) has an undulating form, following the original form of the bone epiphysis used to fabricate the piece. The distal ends of both pieces were missing, destroyed by the same fire which also damaged the sickle. There was no trace of grooving on either piece.

Was Artefact Cluster 9 an ancient container?

Containers made from bark, reeds, skins or textiles are ubiquitous in the modern hunter-gatherer world. Textiles made from twined fibres are also well-known from the late Pleistocene archaeological record (Adovasio *et al.* 1996; Soffer *et al.* 2000). In the Levant, organic fibres dated to 19 000 BP occur at the Upper Palaeolithic site of Ohalo II (Nadel 1994). From this perspective, it is probable that hide or textile bags would also have existed

Figure 8. Sickle (RN 100094), part of Artefact Cluster 9.

in the Natufian period, although no direct evidence of them has yet been found. There is, however, considerable circumstantial evidence for the use of various types of container. The form of human skeletal remains at Ain Mallaha indicates that a corpse was deposited in a rigid box (Bocquentin in Valla *et al.* 2001: 84). Pronounced wear on the first molar of *Homo 3* from Wadi Hammeh 27 suggests the use of the tooth for manipulating organic materials. Clear dental evidence for fibre working has also been found at several Natufian sites, including Ain Mallaha (Bocquentin 2003: 434-40; Bocquentin *et al.* 2005), where the proximity of the site to Lake Huleh and the exploitation of fish imply the production of fibres for use in nets. Less well-known are ethnographic examples of bags or baskets with internal pockets or compartments. This possibility is relevant in the present case, because of the question of how the various groups of small items in Artefact Cluster 9 could have retained their clustered nature if they had been carelessly placed down in a sack or bag. Nonetheless, this is feasible if the items had been secured at the bottom of a bag or basket, or wrapped in rolls of hide or fabric. Such facilities are known from the ethnographic record, for example bark rolls used to transport groups of stone blades in Western Australia (Tindale 1985), and hide pouches used to store small items in central Australia (Spencer 1922).

Functions of the Artefact Cluster 9 objects

The items comprising Artefact Cluster 9, and their possible functional relationships, can be better understood by considering the context of similar artefacts and materials found at Wadi Hammeh 27. The following discussion revisits each group of objects in turn. It is likely that the *gazelle phalanges* were intended for conversion into a type of bead commonly found at Wadi Hammeh 27. The 'gazelle podial bead' consists of the severed distal epiphysis of a

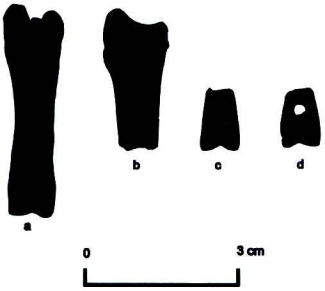

Figure 9. Stages in the production of the 'gazelle podial bead' at Wadi Hammeh 27: (a) drilled first phalanx, (b) proximal phalangeal waster, (c-d) complete beads.

phalanx, drilled dorso-ventrally for suspension. Both first and second phalanges were used as raw materials in its manufacture. Forty of the beads were retrieved from Wadi Hammeh 27 and they are quite uniform in appearance (Figure 9 c-d). Deposits of gazelle hooves, piles of sorted bones and unfinished beads illustrate the steps involved in the production of the gazelle podial bead. Two separate intact gazelle hooves were found on interior floors. There was also a pile of 15 gazelle phalanges (five proximal and 10 medial phalanges), sourced from at least five hooves, stockpiled with a finished gazelle podial bead and bone pendant (Artefact Cluster 4). There were two steps in fabrication; drilling dorso-ventrally through the distal epiphysis of a phalanx (Figure 9a), and sawing through the shaft of the bone proximal to this point. The latter action created a proximal bone fragment as a by-product (Figure 9b).

There were no other large groups of *alluvial pebbles* similar to the aggregation in Artefact Cluster 9. The smaller stones may have been used as slingshot projectiles. One of the larger siliceous limestone pebbles bears pitting, indicating its use as a hammerstone for knapping.

The single-platform *flint bladelet core* was the predominant core type at Wadi Hammeh 27. It is known from several sites that Natufian core reduction strategies involved several pathways (Marder & Valentin in Valla *et al.* 2001). Wadi Hammeh 27 has produced many large retouched flake tools such as burins and scrapers, but few large flake cores. It is likely that large cores were routinely transformed into small ones by direct percussion and then sometimes heat-treated (Edwards & Edwards 1990), followed by a second phase of reduction aimed at producing small flakes and bladelets suitable for conversion into lunates.

Most of the *lunates* in Artefact Cluster 9 were formed by Helwan retouch. Compared with the more widely encountered technique of backing (abrupt retouch), this mode of retouch entails a rather complex means of shaping a blade, but it is not difficult to accomplish. One method of achieving it involves nestling the blank in the palm of the hand on a pad of fabric or leather and using a hand-held percussor in the other to press minute flakes off an edge. The blank is then inverted in the hand and the same process applied to the other face (Valla 1984: 27; Edwards 1987: 206; Goring-Morris 1987: 303), thereby producing an edge with a V-shaped cross-section. This reduction sequence, which requires the forming of inverse retouch on a lunate as a preparatory step to the production of Helwan retouch, is consonant with the presence of inverse-retouched lunates in Artefact Cluster 9. Incomplete or unfinished application of Helwan retouch to an edge may also produce obverse semi-steep retouch and alternating retouch. The latter mode of retouch results in *'inverse and obverse retouch appearing on the same edge or edges and placed so that at no point along them*

do they occur together.' (Marks 1976: 376). Such lunates may represent unfinished Helwan lunates, or alternatively, satisfaction on the knapper's part that the desired shape had already been achieved. Helwan retouch (at 80 per cent for a sample of 350 lunates) was by far the most commonly employed mode of retouch used in lunate manufacture at Wadi Hammeh 27 (Edwards 1987: 105, 205-6; 1991a: 143). If the modes of inverse, obverse semi-steep retouch and alternating retouch are included in this estimate, on the grounds that they are technologically similar, then the proportion rises to 87 per cent (N = 350). Dense clusters of lunates are not otherwise found at the site, although an overlapping burnt pair occur elsewhere inside Structure 1 (Artefact Cluster 13, Figure 4), with several others scattered in its general vicinity.

Strong circumstantial evidence indicates that the lunate was used as a projectile point, but whether to arm spears or arrows is not entirely clear (Valla 1987), since hafted lunates have not been found. The best clue to the microlith's function comes in the form of a specimen with its long edge embedded in a human vertebra, found at El Wad (Bocquentin & Bar-Yosef 2004). This example might indicate that the microlith was sometimes hafted transversally in the manner of Pre-Dynastic Egyptian arrows (Clark *et al.* 1974), but a number of other arrangements are also possible (Bar-Yosef 1987). From a functional point of view it is unclear why Helwan retouch was employed at all, because it is not evident why the hafting of the lunate would require it. Indeed, the technique was progressively discontinued in the later phases of the Natufian in favour of simple backing (Bar-Yosef & Valla 1979).

Helwan retouch was usually applied only to lunates and sickle blades; its deployment in making the former tool may have been a non-utilitarian extension of its utilisation in forming the latter. In the case of the *sickle* blade there was a simple, functional rationale for its use, since the V-shaped profile of a Helwan-retouched edge is well suited to fit into the complementary groove of a sickle haft. As at other Natufian sites (Anderson-Gerfaud 1988), Wadi Hammeh 27's Helwan blades and bladelets display microscopic use-wear patterns, such as rounding, sleeking and the development of 'comet-tails' around small pitted areas, which are characteristic of longitudinal harvesting motions (Stanin 2000). Botanical evidence from Wadi Hammeh 27 demonstrates the gathering of wild barley (Colledge 2001). Many loose sickle blades bearing silica sheen were found at Wadi Hammeh 27, some of which had been burnt incidentally in fires lit on the interior floors (Hardy-Smith & Edwards 2004). The situation attests to the fact that these tools were routinely returned home after use in the field, with the exhausted blades being deposited in accumulations of domestic trash.

The double sickle in Artefact Cluster 9 represents one of the few cases where Helwan bladelets have been found *in situ* (cf. the fragmentary sickle from El-Wad, Garrod 1932: Figure 2). Wadi Hammeh 27 has yielded an unusually large number of bone sickles, including eight complete or near-complete hafts and fragments of 47 more (about 80 per cent of published examples from Natufian sites). None of these were associated with bladelets, however. The sickle hafts are notably varied in shape, some large and scimitar-like, others short and slim, and it is not clear whether these differences relate to tool functionality. The grooves of all specimens are similar in depth and thickness, although some are markedly shorter than others. No traces of grooving were found on the adjacent fire-damaged and

fragmentary bone pieces, suggesting that they did not function as a composite *handle* of a second sickle.

Discussion

The conformation of Artefact Cluster 9 indicates that its constituents were probably lodged within a container. The careful segregation of each group of objects might imply that they were periodically selected and replaced, as circumstances demanded, for use in various tasks. The most plausible explanation for the cache is that it served as a toolkit carried in a bag or basket which was intended for use on offsite foraging excursions. Firstly, the cache's centrepiece, the sickle, was only employable in an offsite context, and the same logic can also be applied to the lunates. There is also a direct relationship between specific groups of objects, such as the core and the lunates struck from the same, rare nodule of flint, implying that they were used at the same time.

Several intriguing questions emerge if we accept the likelihood that Artefact Cluster 9 represents a toolkit intended for use on offsite trips. Was the kit intended for individual use, or to provision a group of foragers? If the former situation was the case, did an individual perform all functions implied by the bag's contents, that is to say flint knapping, point shaping, retooling, hunting, reaping and bead production? And if so, were gathering activities, often attributed as a female role in hunter-gatherer societies and those of hunting and tool-making often ascribed to males, carried out by individuals of either gender? Was the tool kit designed for short trips made in the vicinity of the Wadi Hammeh 27 base-camp, or for longer journeys to smaller, seasonal sites? If mobility was a priority on ranging expeditions, why did the ensemble include small bones used to produce beads, when such ornaments were also made routinely at the home-base?

The answers to the questions about gender roles, and individual versus group provisioning, must remain elusive. However, it is possible to respond plausibly to the other questions if we consider some of the logistical constraints of hunting expeditions. Natufian hunters targeted a wide range of prey species. The taxonomic inventory at Wadi Hammeh 27 included aurochs, red deer, roe deer, fallow deer, equid, goat, pig, fox, cat, hare, stork, duck, partridge, gull, coot, owl and tortoise (Edwards 1991a) but the most commonly taken species was the gazelle (66 per cent of identified bone fragments). The gazelle is represented mainly by phalanges, and a specific identification is not possible. However, on biogeographical grounds the animal represented is likely to be the mountain gazelle, or *Gazella gazella*. This gracile antelope is fleet-footed and wary. Males have an average weight of 25kg, and females 18kg (Baharav 1974), so that a kill in its entirety could feasibly be transported by an individual hunter. Entire gazelle carcasses, for example, were returned to El Wad Cave for butchering during the Natufian period (Bar-Oz *et al.* 2004).

Little is known about specific Natufian hunting methods. Campana and Crabtree (1990) have suggested, on the basis of faunal composition from the Natufian site of Salibiya 1, that nets may have been employed in mass drives to take mammals such as gazelle. However, the interpretation of such faunal profiles remains ambiguous and open to several interpretations (Edwards 1991b). Although no remains of netting has survived, the dental evidence from Mallaha provides the most convincing evidence available for the production

of fibres (Bocquentin *et al.* 2005). Nonetheless, it can be reasonably assumed that a wide range of hunting methods were employed by Natufian hunters, given the broad range of animals acquired by them. One strategy may have involved the use of throwing spears to target individual animals. If we consider the need to prepare and repair projectiles during hunting trips, Artefact Cluster 9 is intelligible as the consequence of two related concepts that seek to explain hunter-gatherer technological and logistical organisation: that of 'time budgeting' developed by Torrence (1983) and 'maintainability and reliability' of hunting gear by Bleed (1986).

Torrence stressed the importance of preparedness and mobility on the part of a hunter likely to encounter fleet-footed prey animals. In this scenario, the hunter needs to be ready to pursue the quarry, as a first strike by a projectile will often wound, rather than kill. If a projectile is damaged, the hunter will need to fall back on a prepared replacement. A ready supply of points or link-hafts may enable a hunter to re-arm a projectile even while engaged in a pursuit. The standardised form of the lunate is thus explicable in terms of the predictability required for hafting, when speed is of the essence (Bleed 1986). Although any unretouched sliver of stone would provide an effective, sharp end to a spear, microliths such as lunates could be hafted in an orderly and predictable manner during stressful or demanding periods.

In considering possible archaeological evidence for such behaviour, Torrence noted, *'Since tool typologies have not previously been established with time minimization in mind, it is difficult to give a specific example of how a composition could be studied in this way'* (Torrence 1983: 13). Artefact Cluster 9 provides a rare and graphic illustration of this concept because it includes groups of functionally related tools associated in a context of good preservation. Its contents imply a range of maintenance and repair tasks undertaken at intercept locations on hunting trips or during rest periods on foraging excursions. Hammerstones and percussion tools would have been required for knapping and pressure flaking and so we may expect that they also were in the container. The largest stone pebble may have been used as a hammerstone to dislodge blades from the core, and the pitting and crushing on its edge indicates that it was used in such a way. The second damaged *handle* thus becomes intelligible as a percussor for transforming blades into lunates by pressure-flaking.

The sickle, at least, was not made entirely with utilitarian considerations in mind. The painstaking arrangement of its bladelets, with one range of tan flint and the other of grey was undertaken for aesthetic or symbolic reasons. Torrence notes that: *'In plant-based economies the subsistants are less complex. The pursuit of immobile resources means that constraints placed on technology as a result of demands for scheduling activities are reduced'* (Torrence 1983: 13). Natufian reaping and processing gear provides an unusual departure from this maxim. Both at Wadi Hammeh 27 and at other Natufian sites (e.g. Turville-Petre 1932: Figure 1), sickles, and basalt mortars and pestles were decorated with schematic, geometric or zoomorphic motifs. In the Levantine record, such embellishments are not common before or after the Natufian period, but coincide with the first large-scale exploitation of cereals and other plants. The protracted business of relief carving added considerably to the time invested in their manufacture and presumably attests to the special regard with which these tools were held, beyond the necessities of function. It is likely that, having been used for a variety of offsite tasks some 14 000 years ago, Artefact Cluster 9 was returned by its owner at day's

end to Wadi Hammeh 27, laid in an unobtrusive place near the wall of Structure 1, and eventually abandoned there.

References

Abed, A.M. 1985. Geology of the Damya Formation. *Dirasat* 12: 99-108.

Adovasio, J.M., O. Soffer & B. Klema. 1996. Upper Palaeolithic fibre technology: interlaced woven finds from Pavlov I, Czech Republic, *c*. 26 000 years ago. *Antiquity* 70: 526-34.

Anderson–Gerfaud, P. 1988. Using prehistoric stone tools to harvest cultivated wild cereals: preliminary observations of traces and impact, in S. Beyries (ed.) *Industries lithiques: tracéologie et technologie* (British Archaeological Reports International Series 411): 175-95. Oxford: British Archaeological Reports.

Baharav, D. 1974. Notes on the population structure and biomass of the mountain gazelle, *Gazella gazella gazella*. *Israel Journal of Zoology* 23: 39-44.

Bar-oz, G., T. Dayan, D. Kaufman & M. Weinstein-Evron. 2004. The Natufian economy at el-Wad Terrace with special reference to gazelle exploitation patterns. *Journal of Archaeological Science* 31: 217-31.

Bar-Yosef, O. 1970. The Epi-palaeolithic cultures of Palestine. Unpublished PhD thesis, Hebrew University, Jerusalem.

–1987. Direct and indirect evidence for hafting in the Epi-palaeolithic and Neolithic of the southern Levant, in D. Stordeur (ed.) *La main et l'outil: manches et emmanchements préhistoriques*: 155-64. Lyon: Maison de l'Orient/ De Boccard.

–2002. Natufian: a complex society of foragers, in B. Fitzhugh & J. Habu (ed.) *Beyond foraging and collecting: evolutionary change in hunter-gatherer settlement systems*: 91-149. New York: Kluwer/ Plenum.

Bar-Yosef, O. & F.R. Valla. 1979. L'évolution du Natoufien: nouvelles suggestions. *Paléorient* 5: 145-52.

Bleed, P. 1986. The optimal design of hunting weapons: maintainability or reliability. *American Antiquity* 51: 737-47.

Bocquentin, F. 2003. Pratiques funéraires, paramètres biologiques et identités culturelles au Natoufien: une analyse archéo-anthropologique. Unpublished PhD thesis, Université de Bordeaux 1.

Bocquentin, F. & O. Bar-Yosef. 2004. Early Natufian remains: evidence for physical conflict from Mt Carmel, Israel. *Journal of Human Evolution* 47: 19-23.

Bocquentin, F., P. Sellier & P. Murail. 2005. Abrasion dentaire et travail spécialisé dans la population natoufienne de Mallaha (Israël). *Comptes Rendus Palevol* 4: 351-57.

Byrd, B. 1989. The Natufian: settlement variability and economic adaptations in the Levant at the end of the Pleistocene. *Journal of World Prehistory* 3: 159-98.

Campana, D.V. & P.J. Crabtree. 1990. Communal hunting in the Natufian of the southern Levant: the social and economic implications. *Journal of Mediterranean Archaeology* 3: 223-43.

Clark, J.D, J.L. Phillips & P.S. Staley. 1974. Interpretations of prehistoric technology from ancient Egyptian and other sources. Part 1: Ancient Egyptian bows and arrows and their relevance for African prehistory. *Paléorient* 2: 323-88.

Colledge, S. 2001. *Plant exploitation on Epipalaeolithic and early Neolithic sites in the Levant* (British Archaeological Reports International Series 986). Oxford: John & Erica Hedges.

Edwards, P.C. 1987. Late Pleistocene Occupation in Wadi al-Hammeh, Jordan Valley. Unpublished PhD thesis, University of Sydney.

–1991a. Wadi Hammeh 27: An Early Natufian site at Pella, Jordan, in O. Bar-Yosef & F.R. Valla (ed.) *The Natufian Culture in the Levant*: 123-48. Ann Arbor: International Monographs in Prehistory.

–1991b. More than one, less than five hundred: comments on Campana and Crabtree, and communal hunting. *Journal of Mediterranean Archaeology* 4/1: 109-20.

Edwards, P.C. & W.I. Edwards. 1990. Heat treatment of chert in the Natufian Period. *Mediterranean Archaeology* 3: 1-5.

Garrod, D.A.E. 1932. A new Mesolithic industry: the Natufian of Palestine. *Journal of the Royal Anthropological Institute* 62: 257-70.

Goring-Morris, A.N. 1987. *At the edge: terminal Pleistocene hunter-gatherers in the Negev and Sinai* (British Archaeological Reports International Series 361). Oxford: British Archaeological Reports.

Hardy-Smith, T. & P.C. Edwards. 2004. The garbage crisis in prehistory: artefact discard patterns at the Early Natufian site of Wadi Hammeh 27 and the origins of household refuse disposal strategies. *Journal of Anthropological Archaeology* 23: 235-89.

Macumber, P.G. 1992. The geological setting of Palaeolithic sites at Tabaqat Fahl, Jordan. *Paléorient* 18/2: 31-44.

Marks, A.E. 1976. Glossary, in A.E. Marks (ed.) *Prehistory and Paleoenvironments of the Central Negev, Israel*: 371-83. Dallas: Southern Methodist University Press.

Nadel, D. 1994. 19,000-year-old twisted fibers from Ohalo II. *Current Anthropology* 35: 451-58.

SOFFER, O., J.M. ADOVASIO, J.S. ILLINGWORTH, H.A. AMIRKHANOV, N.D. PRASLOV & M. STREET. 2000. Palaeolithic perishables made permanent. *Antiquity* 74: 812-21.

SPENCER, B. 1922. *Guide to the Australian Ethnological Collection exhibited in the National Museum of Victoria*. Melbourne: Government Printer.

STANIN, Z. 2000. Hammeh and Sickle: functional analysis of Helwan bladelets from the Natufian site of Wadi Hammeh 27, Jordan. Unpublished Hons thesis, La Trobe University, Melbourne.

STUTZ, A. 2004. The Natufian in real time? Radiocarbon date calibration as a tool for understanding Natufian societies and their long-term prehistoric context, in C. Delage (ed.) *The last hunter-gatherers in the Near East* (British Archaeological Reports International Series 1320): 13-37. Oxford: John & Erica Hedges.

TINDALE, N.B. 1985. Australian Aboriginal techniques of pressure-flaking stone implements: some personal observations, in M.G. Plew, J.C. Woods & M.G. Pavesic (ed.) *Stone tool analysis: essays in honor of Don E. Crabtree*: 1-33. Albuquerque: University of New Mexico Press.

TORRENCE, R. 1983. Time budgeting and hunter-gatherer technology, in G. Bailey (ed.) *Hunter-Gatherer Economy in Prehistory*: 11-22. Cambridge: Cambridge University Press.

TURVILLE-PETRE, F. 1932. Excavations in the Mugharet el-Kebarah. *Journal of the Royal Anthropological Institute* 62: 271-76.

VALLA, F.R. 1984. *Les industries de silex de Mallaha (Eynan) et du Natoufien dans le Levant* (Mémoires et Travaux du Centre de Recherche Français de Jérusalem 3). Paris: Association Paléorient.

–1987. Les Natoufiens connaissient-ils l'arc?, in D. Stordeur (ed.) *La main et l'outil: manches et emmanchements préhistoriques*: 165-74. Lyon: Maison de l'Orient/ De Boccard.

–1998. The first settled societies – Natufian (12,500-10,200 BP), in T.E. Levy (ed.) *The Archaeology of Society in the Holy Land*: 169-87. London: Leicester University Press.

VALLA, F.R., H. KHALAILY, N. SAMUELIAN, R. MARCH, F. BOCQUENTIN, B. VALENTIN, O. MARDER, R. RABINOVICH, G. LE DOSSEUR & L. DUBREUIL. 2001. Le Natoufien Final de Mallaha (Eynan), deuxième rapport préliminaire: les fouilles de 1998 et 1999. *Journal of the Israel Prehistoric Society* 31: 43-184.

WEBB, S.G. & P.C. EDWARDS. 2002. The Natufian human skeletal remains from Wadi Hammeh 27. *Paléorient* 28: 103-24.

WEINSTEIN-EVRON, M. 1998. *Early Natufian el-Wad revisited* (Etudes et recherches archéologiques de l'Université de Liège 77). Liège: ERAUL.